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AGRICULTURAL MEMORANDUM NO 911

The dependence of Potential Transpiration on Stomatal Resistance - a simple approach using meteorological data for one station, by M. Field.

Summary 20 years' weather data from Honington Met Office are used to obtain mean monthly estimates of Potential Transpiration using 2 Methods,

(a) a full combination equation

(b) a method outlined in Technical Bulletin No 16, namely using the departure of monthly sunshine from the climatological average as a 1st order correction to the mean monthly PT.

The dependence of PT on stomatal resistance is investigated and the values of r_s which are required to bring Method (a) into agreement with Method (b) are found.

The calculation of PT

Method (a)

$$PT = \frac{\Delta(RNS-RNL-G)+43(SVP-VP)/r_a}{\Delta + 0.66(1+r_s/r_a)} \quad (mm/day)$$

where $r_a = \frac{250}{m(1+0.54u)}$ (s/m)

u = mean daily windspeed at 1.2 m (m/s)

$$m = \frac{\ln(z/z_{op})\ln(5z/z_{op})}{\ln(z/z_o)\ln(5z/z_o)}$$

z_o = roughness length = 2 cm

z_{op} = 1.37 mm

z = 1.2 m

(see Agricultural Memorandum No 889 for further information on the terms in this equation).

Method (b)

$$\text{daily PT}]_{\text{month}} = \text{PT}]_{\substack{\text{'mean daily PT'} \\ \text{for month}}} + X\left[\begin{array}{c}\text{'actual daily sunshine' averaged over month}\end{array} - \begin{array}{c}\text{'mean daily sunshine' for the month}\end{array}\right]$$

(see Appendix for monthly values of 'mean daily sunshine', 'mean daily PT' and 'X')

Results Figures 1 and 2 show the variation of PT with r_s. Figure 3 shows the values of r_s which are required to bring Method (a) into agreement with Method (b). Figure 4 compares monthly PT using Method (b) with that given by Method (a) when r_s assumes the following values,

50s/m from April to September
80s/m from October to March

Conclusions (i) The variation of PT with r_s is approximately linear in the range $30 \lesssim r_s \lesssim 80$ s/m,

(ii) The values of r_s which are required to bring Methods (a) and (b) into agreement are reasonable during the summer months but are too large in the winter. This is to be expected since the winter PT as given in Technical Bulletin 16 is known to have been underestimated.

References Agricultural Memorandum No 889, 1979
MAFF Technical Bulletin No 16 'Potential Transpiration', 1967

Any comments or suggestions on this paper should be referred to the author.

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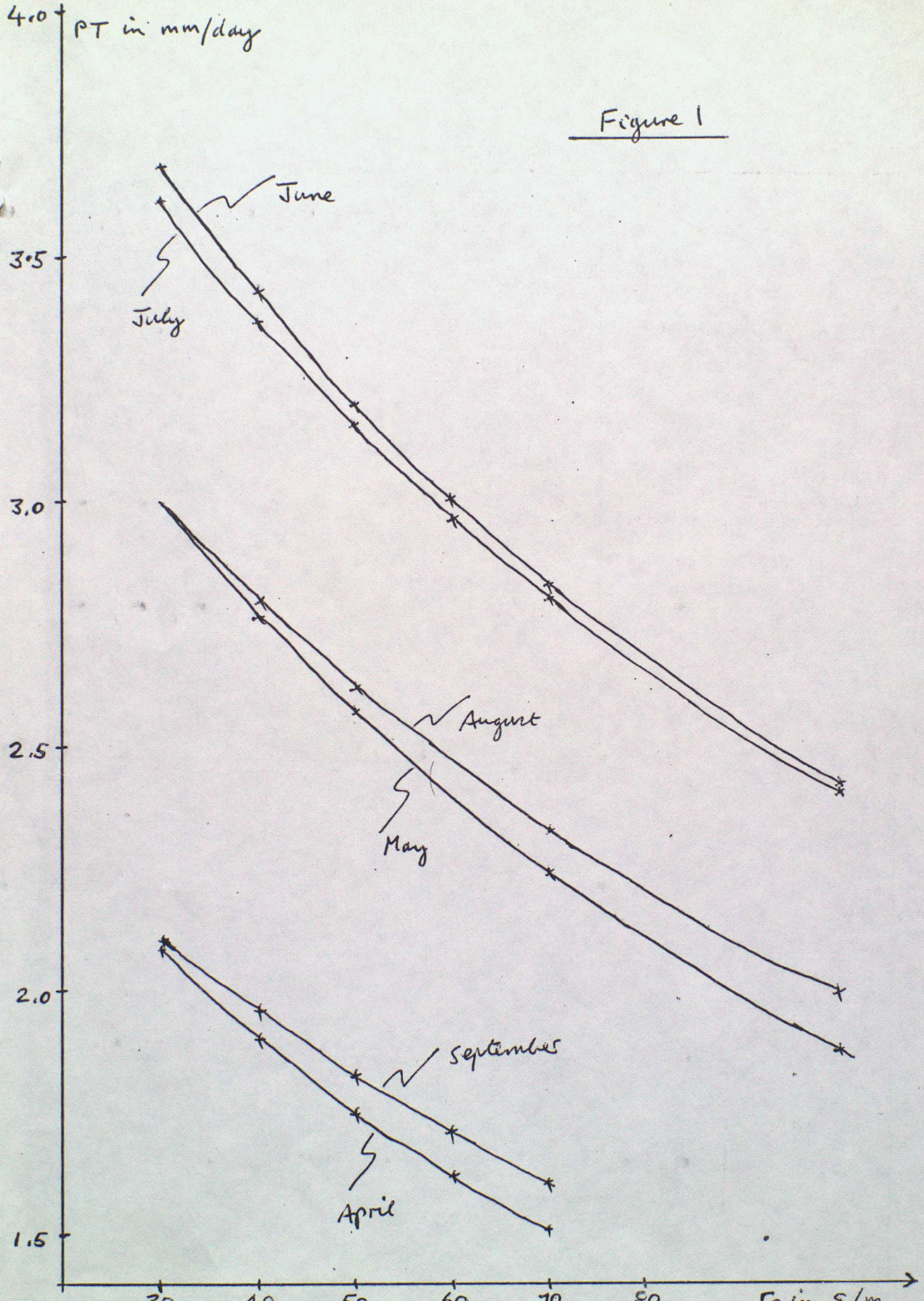
Figure 1


4.0
PT in mm/day
3.5
3.0
2.5
2.0
1.5
June
July
August
May
septembes
April
30
40
50
60
70
80
rs in s/m

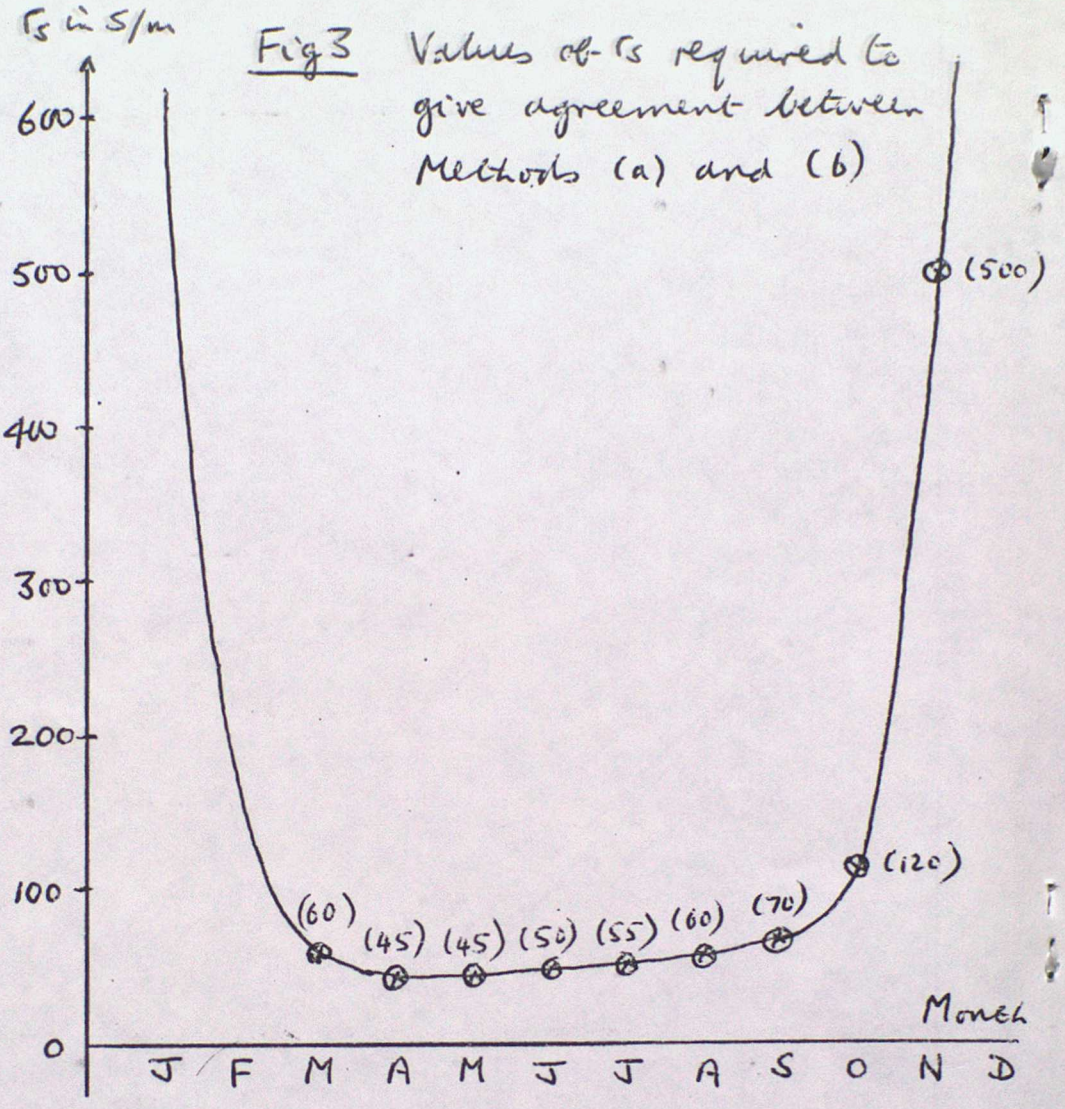


Fig 3 Values of rs required to give agreement between Methods (a) and (b)

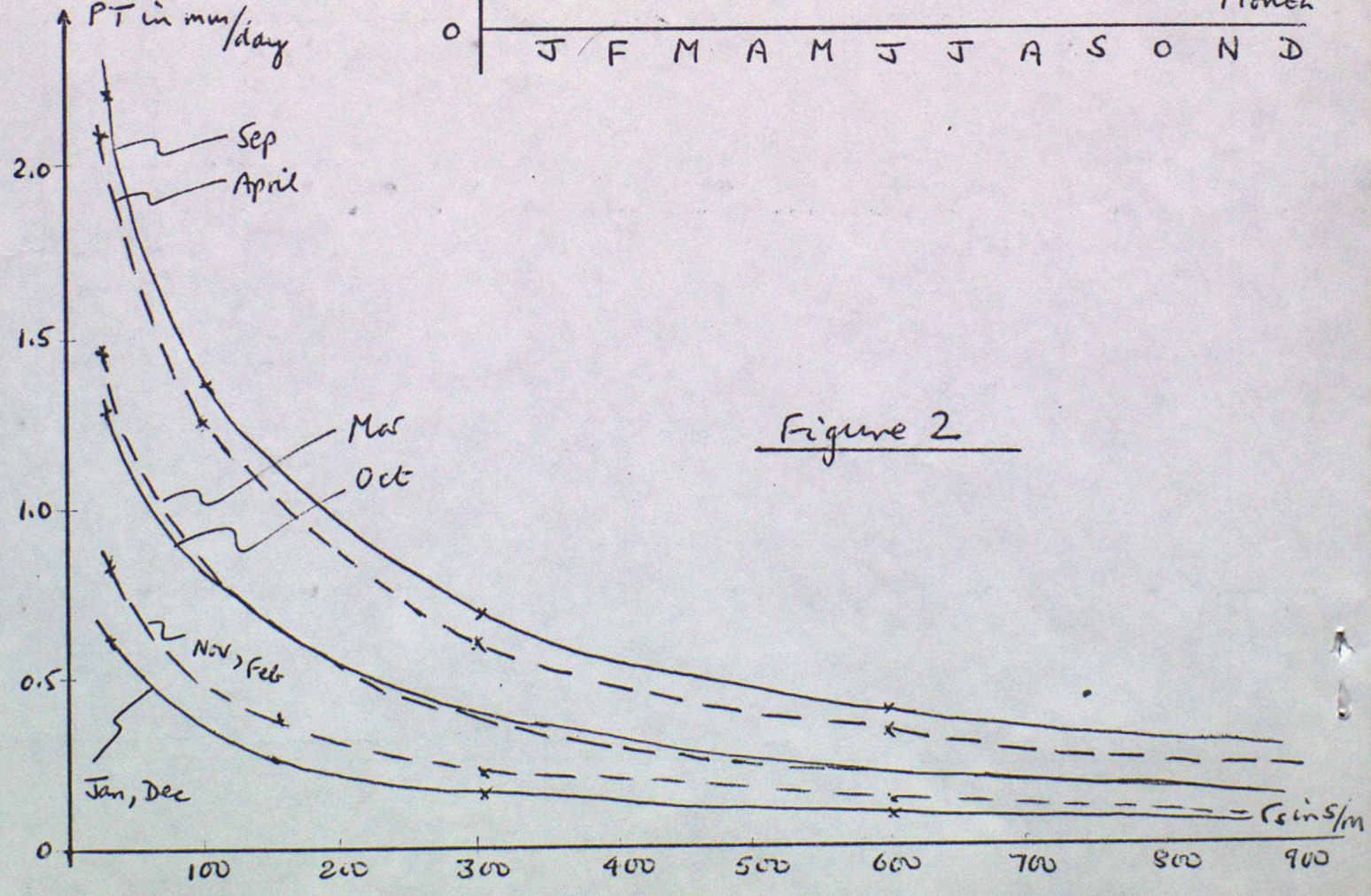


Figure 2

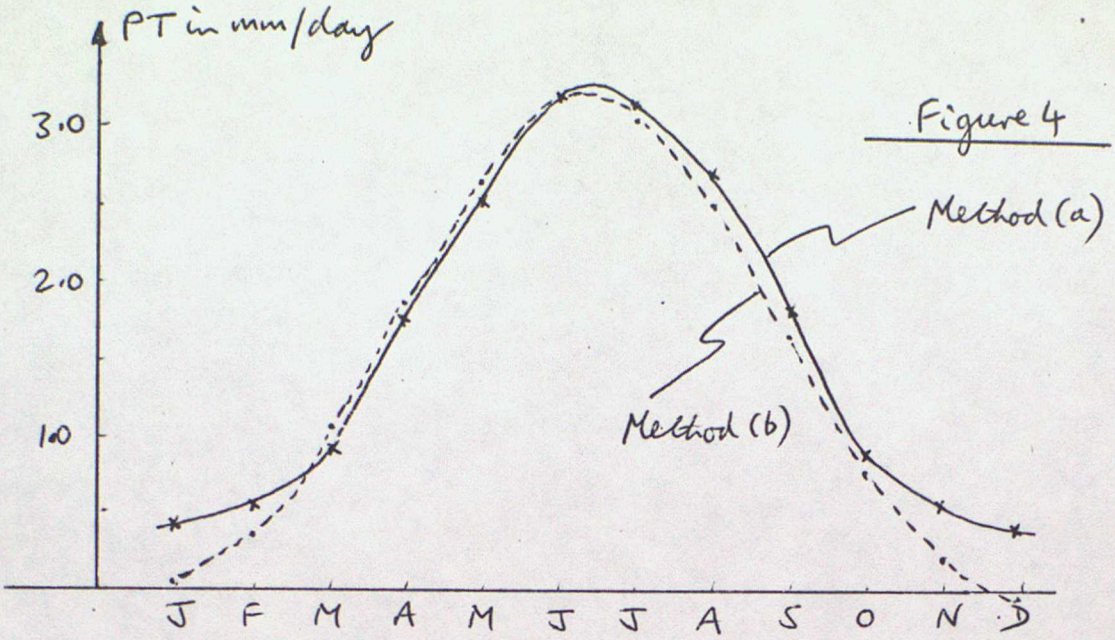


Figure 4

Appendix

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
X (mm per hr)	0	0	0	0.14	0.3	0.32	0.32	0.35	0.28	0	0	0
mean daily sunshine (hr)				5.3	6.4	7.2	6.1	5.9	5.0			
mean daily PT (mm)	0.04	0.36	1.07	1.91	2.70	3.22	3.07	2.54	1.69	0.74	0.17	-0.04

(data extracted from P26 of Technical Bulletin No 16, for the county of Suffolk; units converted from inches to mm)